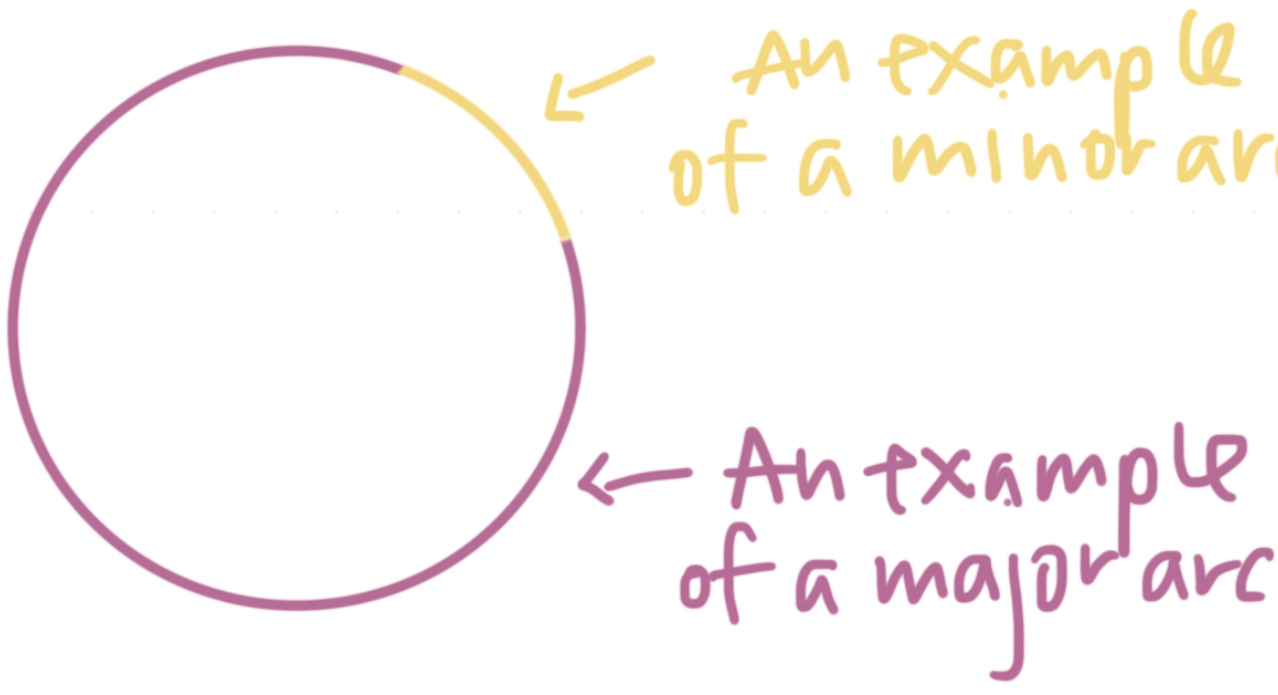
Degree measure of an arc

In this lesson we'll look at arcs of circles and how to find their measure.

Arcs

An **arc** is part of the circumference of a circle. There are three types of arcs.

1. **Minor arcs** are less than $180°$.
2. **Major arcs** are more than $180°$.
3. **Semi-circle arcs** are exactly $180°$.



Measures of arcs and central angles

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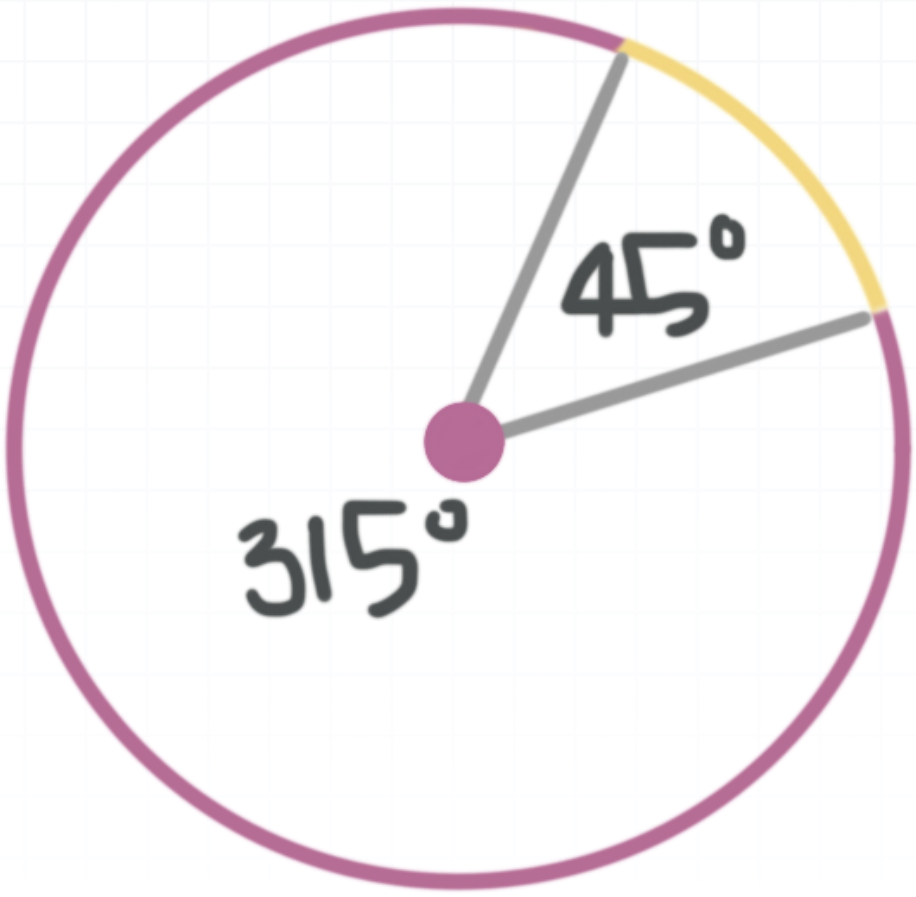
The **central angle** of an arc is the angle that connects both ends of the arc and has a vertex at the center of the circle. The central angle and the arc have the same measure. Here the central angle for the minor arc measures $45°$, so the minor arc is $45°$.



The central angle for the major arc is $315°$, so the measure of the major arc is $315°$. The sum of the central angles of a circle always add to $360°$.

Naming arcs and their measures

You can name an arc by the letters that name the beginning and endpoints of the arc on the circle. For example the yellow arc shown below is arc AB. Instead of writing the word arc, we could also use a curved symbol over the letters to indicate the arc, like $\overset{\frown}{AB}$.

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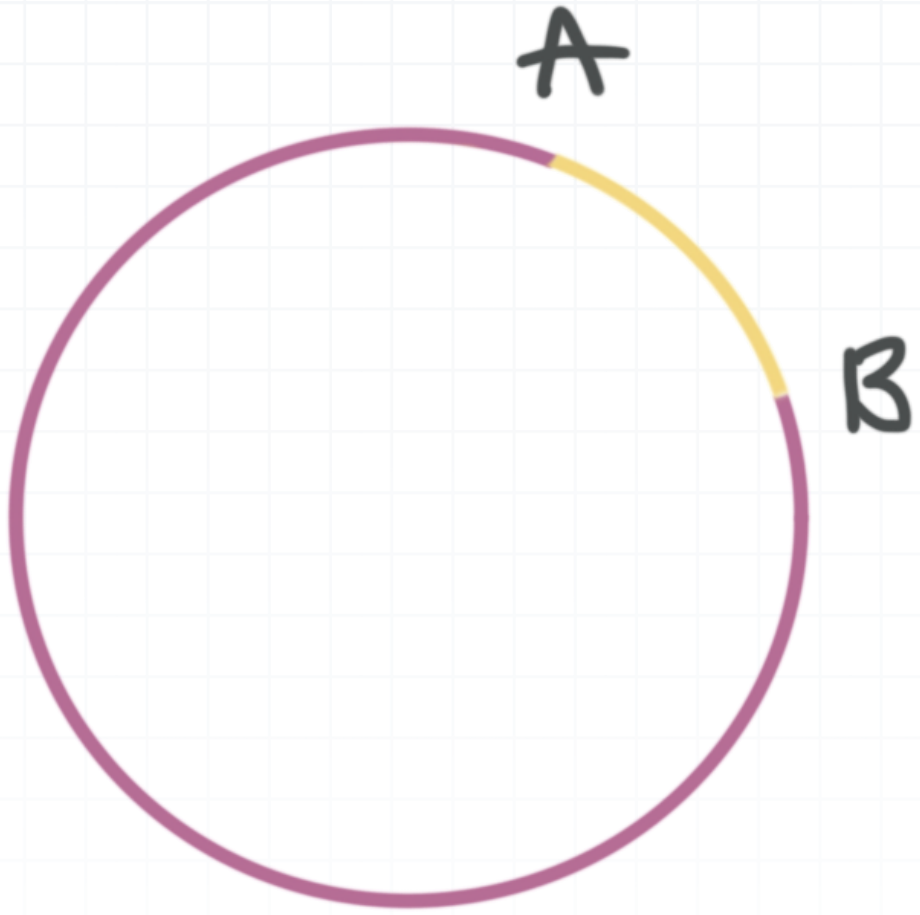

The measure of arc AB is given by the number of degrees in arc AB. Then you add the symbol m or the word "measure." In this case we can say the measure of arc AB is equal to $45°$. If we used all symbols we could write $m\overset{\frown}{AB} = 45°$.

Let's look at a few examples.

Example

What is the difference between the measures of arc BD and arc AE, given that $\overline{AD}$ is a diameter of circle C?

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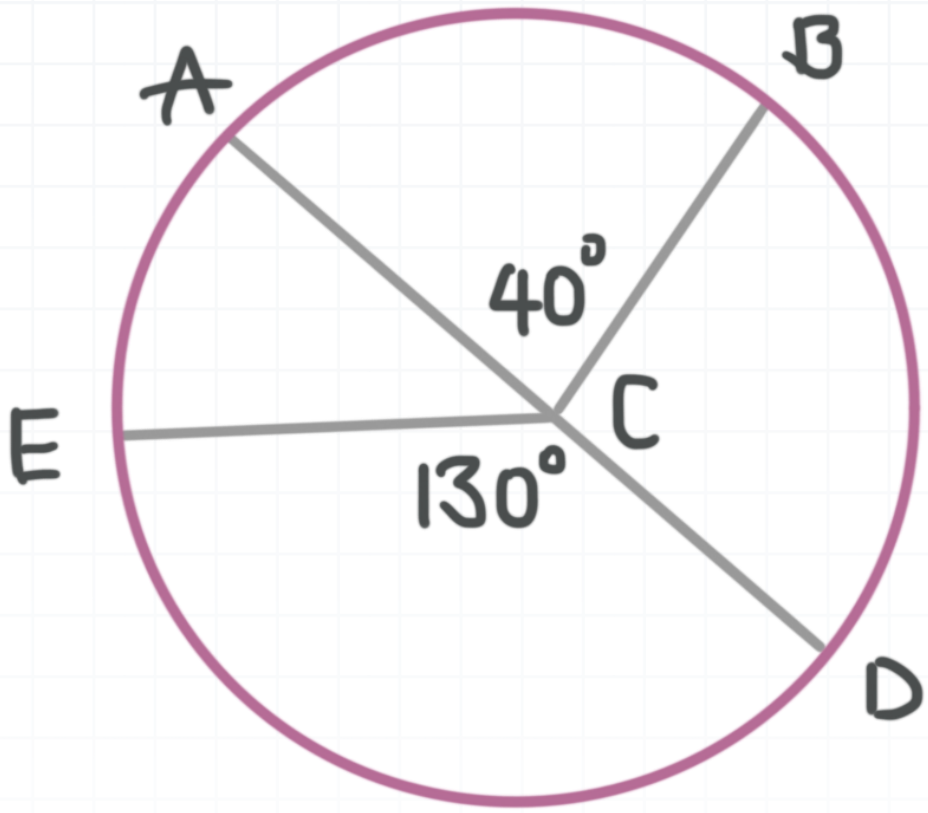

The diameter of the circle is $\overline{AD}$, which means the sum of the measures of arc AB and arc BD is $180°$.

$$40° + m\overset{\frown}{BD} = 180°$$

$$m\overset{\frown}{BD} = 140°$$

Likewise, the sum of the measures of arc DE and arc AE is $180°$.

$$m\overset{\frown}{DE} + m\overset{\frown}{AE} = 180°$$

$$130° + m\overset{\frown}{AE} = 180°$$

$$m\overset{\frown}{AE} = 50°$$

The difference between these two arcs is

$$140° - 50° = 90°$$

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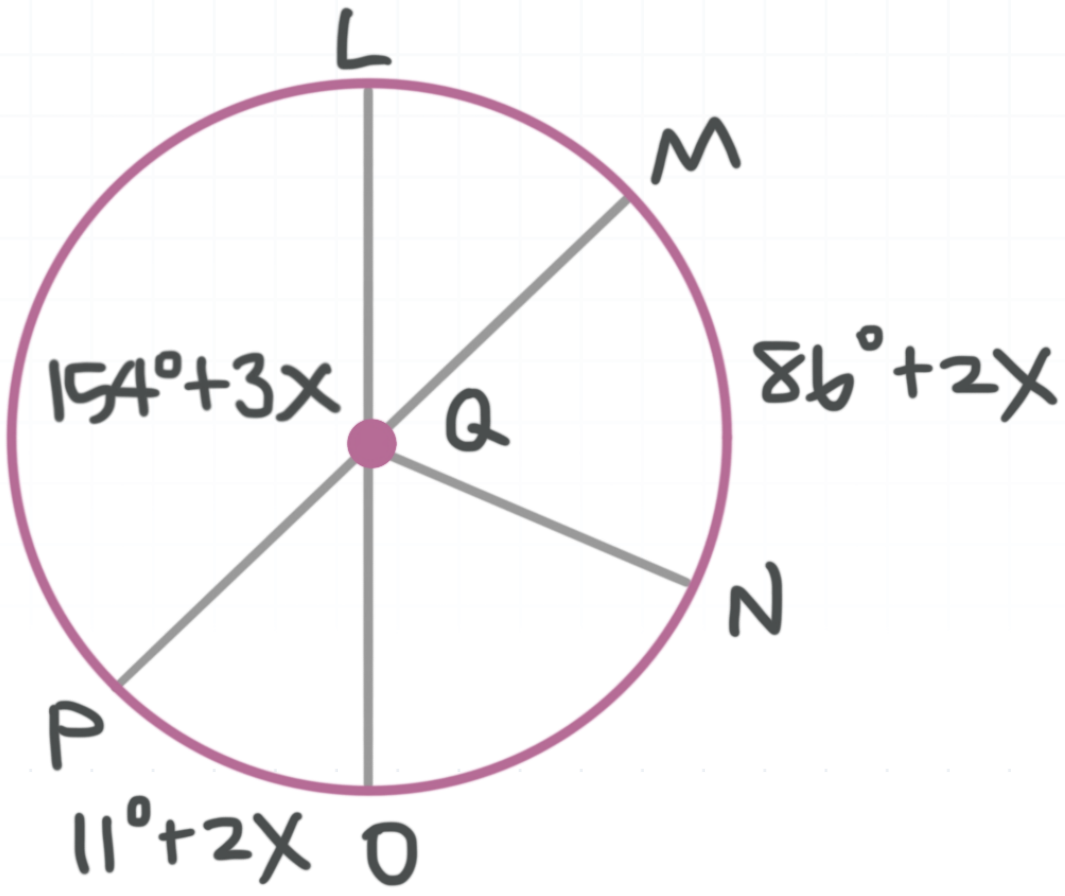
Let's look at one more example.

Example

Find the measure of an arc. What is the measure of arc MN, given that $\overline{LO}$ is a diameter of circle Q?



We need to solve for x and then plug it back into the expression for the value of arc MN. We know that $\overline{LO}$ is a diameter of circle Q, so the sum of the measures of arc LP and arc PO is $180°$.

We can use this information to find the value of x.

$$m\widehat{LP} + m\widehat{PO} = 180°$$

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Central angle LQP has a measure of $154° + 3x$, which means that arc LP also has the same measure. Then we can say

$$154° + 3x + 11° + 2x = 180°$$

$$165° + 5x = 180°$$

$$5x = 15°$$

$$x = 3°$$

Now we can find the measure of arc MN.

$$m\widehat{MN} = 86° + 2x$$

$$m\widehat{MN} = 86° + 2(3°)$$

$$m\widehat{MN} = 92°$$

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